Spatial and Temporal Analysis of Red Light Running Citations and Crashes in Lincoln, Nebraska

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Background

- Red light running (RLR) is a dangerous traffic violation.
- Officer enforcement is the main law enforcement method of discouraging RLR in Nebraska.
- The comparison of the distributions of citations and crashes can reflect the effectiveness of the RLR law enforcement.

Research Objective

- To analyze if the distributions of RLR citations and crashes are consistent in space and time.

Methodology

- Spatial analysis: Bivariate Moran’s I and LISA using GeoDa.
- Temporal analysis: radar plot.
- Spatio-temporal analysis: Kulldorff’s space-time permutation scan statistic using SaTScan.

Data Collection

2007-2013 RLR citation and crash data in Lincoln, NE.

<table>
<thead>
<tr>
<th>Type</th>
<th>Citation</th>
<th>Crash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum</td>
<td>7676</td>
<td>1454</td>
</tr>
<tr>
<td>Intersections</td>
<td>562</td>
<td>314</td>
</tr>
</tbody>
</table>

Data Analysis – Spatial Analysis

Results of Moran’s I:
- Two Moran’s I values are nearly 0. Thus, no global clustering or dispersion exists.

Data Analysis – Temporal Analysis

Cluster | Radius (km) | Time frame |
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<tbody>
<tr>
<td>0.12</td>
<td>7:00 to 15:00</td>
<td></td>
</tr>
<tr>
<td>0.18</td>
<td>7:00 to 8:00</td>
<td></td>
</tr>
<tr>
<td>0.74</td>
<td>14:00 to 15:00</td>
<td></td>
</tr>
<tr>
<td>3.61</td>
<td>9:00 to 16:00</td>
<td></td>
</tr>
</tbody>
</table>

The temporal distributions of citations and crashes:
- Consistent by year, month, and day of week.
- Inconsistent by time of day.
- Consistent after eliminating Friday data.

Bivariate LISA cluster map with the variable of interest being crash

Top 100 crash and citation intersections

Results of LISA:
- 92 high-high clusters, 290 low-high outliers, and 27 high-low clusters.
- RLR law enforcement may be adjusted in these locations, especially at the high-low locations.

Conclusions

- The distributions of RLR citations and crashes are not consistent in space and time.
- The current RLR law enforcement may be adjusted by the research results. However, the detailed investigation is strongly recommended before any adjustment.

Acknowledgements

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